Australian Medical Research and Innovation Five Year Strategy

Title: Supporting research leaders in the medical data analytics workforce

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Introduction

Medical research now generates increasingly large and complex datasets. This includes genomics, transcriptomics, epigenomics, proteomics, metabolomics and imaging data, as well as data from devices and medical instruments, and from the clinic. *Bioinformatics and computational biology* (hereafter referred to collectively as bioinformatics) are young multi-disciplinary research fields that apply mathematics, statistics and computer science to analyse and make sense of these data—frequently requiring the development of novel computational methods to achieve this. As medical research has become intensely data-centric, bioinformatics research has come to play an essential role. This extends to personalised medicine, whose realisation cannot occur without a vibrant, world-class Australian bioinformatics eco-system to translate genome-wide data into clinical knowledge and application.

The Australian Bioinformatics and Computational Biology Society (ABACBS) is Australia's first national scientific society representing bioinformaticians. It was formed in September 2014 following broad consultation with the Australian community, recognising the lack of a peak representative body. ABACBS is a rapidly growing society and currently has over 400 members on whose behalf we are making this submission.

The Gap

Bioinformatics research is a vital part of modern medical research, yet current funding models do not adequately support the Australian bioinformatics research community.

As an emerging discipline, Australian bioinformatics research faces many unique problems that directly impact how it is supported by funding agencies and significantly limit its capacity to meet the needs of medical research. These include:

- **Confusion about bioinformatics research versus service and tool use**

The term bioinformatics is broadly used to encompass various activities, including: research that is carried out by independent investigators; a service, for example offered by a core facility; and the application of tools by bench scientists. These different styles lead to confusion amongst peers and distort expectations around collaboration, authorship and grant application for independent bioinformatics researchers. This introduces additional hurdles when bioinformatics research grants and fellowships are reviewed. This proposal focuses on independent bioinformatics research, as well as collaborative activities, but not service or support bioinformatics.

- **Bioinformatics career paths are frequently non-typical**

Bioinformatics research is multi-disciplinary. Many leaders in the field of bioinformatics started in other disciplines, such as statistics, mathematics or computer science. These backgrounds are an advantage in providing a solid basis for solving complex analysis questions in medical research, but often lead to delayed career timelines due to changing fields and consequently post-PhD deadlines for fellowships and awards are often missed. This is not currently recognised and represents a significant disadvantage.

- **Track records of bioinformatics researchers look different**

Medical research needs bioinformatics researchers who are willing to collaborate or jointly lead projects part of their time, but the grant and fellowship review system value independent research. Bioinformaticians' track records, even independent researchers, typically have many collaborative middle author publications. These often represent critical research contributions in high impact publications. Meanwhile, first and last author publications on bioinformatics methods are often in field-specific journals with comparatively low impact.

- **Grant and fellowship review panels lack bioinformatics expertise**

For example, NHMRC Project Grant Review Panels typically have at most two bioinformatics researchers sitting on two extremely broadly focused panels and little to no representation on other panels. This is a major disadvantage given the confusion about research versus service roles, requiring expert panel members to dissect this appropriately.

The NHMRC has listed bioinformatics research as priority area, but attempts to take into account the unique discipline-specific challenges of bioinformatics have failed, and this strategic acknowledgement has not translated into increased support for early and mid-career researchers.

Proposed solution

To meet the rapidly increasing need for highly-skilled computational analysis in medical research, and to address the challenges facing bioinformatics research careers in Australia, **we propose that a specific pool of fellowships to support Australian bioinformatics and computational biology researchers and grants to support bioinformatics research groups be funded.** This should cover bioinformatics and computational biology researchers broadly, including those with a translational focus, and at all career stages from Early-/Mid-career through to leaders in the field at the Research Fellowship level. This specific pool needs to be judged against the appropriate criteria for the field.

Additionally, funding models need to better facilitate *the long-term development and maintenance of world-class software and resources* being created by Australian bioinformatics researchers.

We further propose the following strategies be adopted across all areas of medical funding:

- Grant proposals supporting substantial bioinformatics efforts must be reviewed appropriately and utilize adequate numbers of review panel members specialising in bioinformatics
- Grants supporting substantial data generation or analysis must have:

  (i) Suitable investigators responsible for leading the bioinformatics. This should ideally be as Chief Investigators, unless this is prevented by funding scheme rules (e.g. Program grant restrictions) and there is clear evidence of investment in the project.

  (ii) The substantial research effort associated with innovative computational analysis be recognised with appropriate salary support for bioinformaticians.

Benefits

These proposals will have the following benefits:

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- **Support research leaders who will advance the fields of bioinformatics and computational biology in Australia**

This will sustain the leadership in bioinformatics research needed to advance the field. Senior bioinformatics researchers will also collaborate to ensure the quality of analyses of large and complex medical datasets in major national and international projects. Support for senior researchers will also enable the training of the next generation of bioinformaticians.

- **Develop emerging talent in Australia**

The future of medical research in Australia depends on the continual training of talented, motivated and passionate research scientists; providing support for a career trajectory in bioinformatics will address issues around the retention of scientists with skills that are highly sought after across many areas of industry, research and commerce.

- **Secure the bioinformatics workforce needed to address current and future challenges in medical research**

Our proposal, through promoting career opportunity, will create an environment that will lead to sustained research leadership in bioinformatics. This is needed to advance the field, and maintain a highly skilled set of research leaders capable of adapting to the rapidly changing landscape of modern medical research and leading multi-disciplinary teams for the research and development of new methods.

- **Overcome disadvantages compared to international systems where bioinformaticians have better access to funding including similar fellowship schemes (e.g. Initiatives in Biomedical Informatics and Computational Biology (BICB)).**

- **Enable more innovative, productive and insightful medical research**

The rapid technological advancement that is evident in medical research will be enhanced through collaborative, multi-disciplinary research. Bioinformaticians will fulfil a crucial role in these efforts. We assert that future-focused funding must attempt to future-proof our science; investing in a highly trained, research active workforce with diverse skills is of fundamental importance to securing the future benefits that will flow from medical research in Australia and internationally.

- **Funding for bioinformatics research groups will support the development of novel methods needed to drive the state-of-the-art forward, while freeing chief investigators from the need to apply for NHMRC Project grants, leading to greater efficiencies.**

- **Address multiple challenges identified by the Advisory Board, specifically:**
  - Enhance and sustain research enabling technologies, infrastructure and workforce
  - Support research and innovation from concept to delivery
  - Facilitate the translation of research into health outcomes
  - Maximise productivity within the health and research system
  - Reduce barriers to collaboration